

CURRENT LITERATURE

BOOK REVIEWS

A montane rain-forest

As a result of several visits to Jamaica, affording in all about 11 months' residence upon the island, SHREVE¹ has contributed a study of a tropical rain-forest that is particularly valuable, since it represents practically the first attempt to determine quantitatively the factors concerned in the production of such vegetation. The forest investigated covers the Blue Mountains above an altitude of 1372 meters. This ridge, having an altitude of 1500-2265 meters, runs lengthwise of the island and, therefore, is nearly at right angles to the direction of the trade winds. The northern or windward side is fog-covered for 70 per cent of daylight hours during 9 months of the year and for 30 per cent of daylight hours during the remaining months, while the rainfall approximates 425 cm. annually. The southern slope is drier, with less than half the amount of fog, and with an annual precipitation of about 265 cm. A further indication of the humidity is to be found in the evaporation measurements upon the leeward slope, giving maximum and minimum daily average losses of 17.9 cc. and 1.8 cc. (compared with approximately 45 cc. and 10 cc. respectively for the Chicago region) as shown by the standard atmometer placed in the open, with half of these amounts for the forests of the ravines. These low amounts seem to be four or five times as great as for corresponding situations upon the more humid northern slopes.

Temperature has an annual range of 23° C., with the monthly mean from 15° to 17° C., the maximum seldom exceeding 22° C. or the minimum 7° C., while frosts are unknown. Detailed temperature and humidity data for limited periods, as well as soil temperature records, are given.

The mountain soil is very subject to erosion, and this instability may account, in part, for the absence of large trees; still, the forest is very continuous, reaching its best development, however, in ravines, where trees 20 meters in height are seen, with trunks 80 cm. in diameter in such species as *Solanum punctulatum* and *Gilibertia arborea*. There seems to be no great complexity of floristic composition, the forest resembling in this respect temperate forests rather than those of tropical lowlands. This is indicated by the fact that *Clethra occidentalis*, *Vaccinium meridionale*, and *Podocarpus Urbanii* form about 50 per cent of the stand, and that an additional 35 per cent is made

¹ SHREVE, FORREST, A montane rain-forest. A contribution to the physiological plant geography of Jamaica. Washington. 8vo. pp. 110. pls. 29. figs. 18. Carnegie Institution of Washington. Publication 199. 1914. \$1.50.

up of 10 other species. The comparatively small number of lianas, the paucity of floral display, the slow rate of growth, and the absence of plank buttresses and cauliflora, all show rather unexpected variations from the rain-forests of other lands. Epiphytes are abundant, however, but limited to comparatively few species of bromeliads and orchids, a profusion of the Hymenophyllaceae, and a great bulk of mosses and hepatics.

The richer forests of the windward ravines show a distinct stratification of vegetation, passing from the more or less continuous canopy of large trees, through under-trees and shrubs, to the herbaceous carpet, the lower levels being festooned with mosses (species of *Phyllogonium* and *Meteorium*), while the larger limbs and leaning trunks are crowded with orchids and ferns. Among the notable genera, represented by several species each, are tree ferns (*Cyathea*) found among the under-trees, *Piper* occurring among the shrubs, and the herbaceous species of *Peperomia* and *Pilea*. Upon the slopes the trees are smaller, the stratification is less marked, and epiphytes are less abundant, changes that are more accentuated upon the ridges, where a low open canopy results. Here thickets of ferns and of climbing bamboo (*Chusquea abietifolia*) are common. The distinct type of forest occupying the various habitats are all carefully described, and SHREVE concludes that by no possible physiographic change could any one of these habitats occupy all or nearly all the region; hence there is no means to fix on any one of the types as the climax of the region.

The great uniformity of temperature, with no pronounced dry season, affords excellent opportunities for studying the seasonal behavior of the various species. It is quite interesting, therefore, to note that although the months from October to January have a maximum rainfall it is a season of relative rest, during which a few tree species, such as those belonging to *Rhamnus*, *Clethra*, and *Viburnum*, allied to north temperate forms, shed all or a part of their leaves, while others make little growth. This may be accounted for by the comparative lack of sunlight. Other trees, while evergreen, flower in the spring and complete their growth by October; but in still others, growth and leaf formation is continuous, but flowering periodical, while not a few show continuous growth and blooming. Among the large trees belonging to the last category are *Ilex montana* and *Solanum punctulatum*, while under-trees and shrubs include species of *Piper*, *Boemeria*, *Malvaviscus*, and *Datura*. Quite as interesting is the behavior of introduced species, *Quercus robur* and *Liquidambar styraciflua* becoming evergreen, while *Liriodendron Tulipifera* and *Taxodium distichum* retain their deciduous habits.

Rates of relative transpiration in the rain-forest and in the desert of Arizona are found to be of the same order of magnitude, that is, they are proportional to evaporation, but in its own climate the desert plant loses far more water per unit area than the plant of the rain-forest. The foliage of the rain-forest, however, shows great diversity of structure, corresponding to the different strata of vegetation, from sclerophyllous leaves of the trees, the

coriaceous succulent leaves of the epiphytes, and the mesophytic shade leaves of the herbaceous plants, to filmy ferns with leaves composed of a single layer of cells. The effect of rainfall upon the foliage is reported elsewhere,² and it is seen that, with a single exception, all adult leaves are wettable. In spite of this, aside from the Gramineae and Cyperaceae, only four seed plants and two ferns have functioning hydathodes, and dripping points are neither abundant nor conspicuous. Injected leaves were seen only once, and that after five days of violent rains, when those with as well as those without hydathodes alike recovered, showing no evidence of injury. The wettable leaf surface reduces the water intake from the shoot, but does not reduce the temperature to an extent sufficient materially to affect transpiration. Epiphyllous plants are common in the ravines, and in other situations of maximum humidity. They are favored by the wet leaf surfaces, nor do the dripping points, when developed, so greatly promote drying as to reduce the probability of the leaves being thus overgrown. The epiphyllae are mostly Hepaticae of the genus *Lejunea*.

Most of the conclusions arrived at in these two publications are the result of experiment, and are supported by qualitative data, thus marking a new era in the investigation of tropical vegetation, and necessitating a readjustment of many generalizations resting upon less definite evidence. Taken together, they form one of the most notable of recent contributions to our knowledge of rain-forest phenomena.

The importance of the Cinchona Botanical Station, the headquarters from which these investigations were carried on, has been emphasized quite recently by JOHNSON,³ who draws attention to its many advantages for the student who would become familiar with a great variety of tropical conditions or who would undertake the solution of some of the many ecological and physiological problems of tropical vegetation. Situated upon the slopes of the Blue Mountains at an altitude of about 1500 meters, it has a climate agreeable to workers from temperate zones, a supply of pure water, freedom from tropical diseases, and yet from it as a center easy access may be had both to the higher parts of the forest-covered mountains, now reserved by the government of the island as a watershed, and to the more torrid plains below. It has an equipment of residence, laboratories, and greenhouses capable of affording accommodations for eight or ten workers, and gardens and grounds planted with species from other tropical and temperate lands. In addition, two botanical gardens situated in the lowlands can be used as substations of the main laboratory. One at Castleton has an altitude of 150 meters and a rainfall of 355 cm., while the other at Hope at a similar altitude has less than half as much precipitation.

² SHREVE, FORREST, The direct effects of rainfall on hygrophilous vegetation. *Jour. Ecol.* 2:82-98. 1914.

³ JOHNSON, D. S., The Cinchona Botanical Station. *Pop. Sci. Monthly* 85:512-530. 1914; 86:33-48. 1915.

Not less important than the natural advantages of the Station in climate and vegetation is its accessibility, and the fact that it is located in an English-speaking country with a stable government and reliable sanitary control. For the past ten years it has been a station of the New York Botanical Garden, but it is now to be maintained under the auspices of the British Association for the Advancement of Science with the cooperation of the Jamaican government.—GEO. D. FULLER.

NOTES FOR STUDENTS

Cultures of the Uredineae.—In the review covering the cultural work with the Uredineae for 1912,⁴ the following results of TREBOUX and of LONG should have been included. TREBOUX⁵ in two papers from Nowotscherkask, reports the following cultures. Teleutospores of *Uromyces Festucae* Syd. from *Festuca ovina* L. produced aecidia on *Ranunculus illyricus* L. (The reverse culture has previously been reported.)⁶ Aecidiospores from *Allium decipiens* Fisch., *A. moschatum* L., *A. rotundum* L., and *A. sphaerocephalum* L. produced uredospores and teleutospores (*Puccinia permixta* Syd.) on *Diplachne serotina* Lk. The reverse infection on 3 of these and 13 other species of *Allium* was successful also. Teleutospores of *Puccinia stipina* Tranzsch. from *Stipa capillata* L. infected 5 native species of *Salvia* and 15 others grown from seed, and also *Origanum vulgare* L., *Lamium amplexicaule* L., *Glechoma hederacea* L., *Lallemantia iberica* F. et M., *Leonurus cardiaca* L., and *Stachys recta* L. This rust shows very little selection among the Labiatae. *Puccinia littoralis* Rostr. from *Juncus Gerardi* Lois. produced aecidia on *Cichorium Intybus* L. (the reverse culture has been previously reported). Aecidiospores of *Puccinia Polygoni-amphibii* Pers. from *Geranium collinum* Steph. infected *Polygonum amphibium* L. but not *P. lapathifolium* L. The reverse infection was successful on *Geranium collinum* L., *G. pratense* L., *G. divaricatum* Ehrh., *G. columbinum* L., and *G. rotundifolium* L. Aecidiospores of the autoecious form *P. ambigua* Alb. et Schw. on *Galium aparine* L. produced successive generations of aecidia when sown on that host. Aecidiospores of *Puccinia Agropyri* Ell. et Ev. from *Clematis pseudo-flammula* Schmalh. infected *Agropyrum repens* P.B. The uredospores from this culture infected *Agropyrum cristatum* Bess. and *A. prostratum* Eichw. Aecidiospores of *Puccinia bromina* Erikss. from *Lithospermum arvense* L. infected *Bromus tectorum* L. and *B. squarrosus* L. Similarly aecidiospores from *Myosotis silvatica* Hoffm. infected *B. tectorum*. The two aecidia belong to the same rust. Aecidiospores and uredospores of *Uromyces Limonii* (DC.) from *Statice latifolia* Sm. infected *Statice Gmelini* Willd. also. Aecidiospores of an unnamed species of *Puccinia* from *Centaurea trichocephala*

⁴ BOT. GAZ. 56:233-239. 1913.

⁵ TREBOUX, O., Infektionsversuche mit parasitischen Pilzen II. Ann. Mycol. 10:303-306. 1912; and *idem* III. *Ibid.* 557-563. 1912.

⁶ Rev. BOT. GAZ. 56:239. 1913.